

**INDUSTRIAL TECHNOLOGIES  
INDUSTRY SECTOR  
(Dollars in Thousands)**

**INDUSTRIES OF THE FUTURE (CROSSCUTTING)**

**I. Mission Supporting Goals and Objectives**

**Mission**

The Industries of the Future (Crosscutting) Initiative works with IOF industry partners and suppliers to conduct cost-shared R&D on technologies that have potential applications across the nine vision industries as well as provide the immediate tools and technical assistance industry needs to expedite the implementation of energy-efficient, clean manufacturing technologies.

**Program Goals and Benefits**

Industries of the Futures (Crosscutting) is comprised of three program areas: the Enabling Technologies Program, the Financial Assistance Program, and the Industrial Technology Assistance Program.

**Enabling Technologies Program**

The Enabling Technologies Program within the Industries of the Future initiative conducts cost-shared R&D on technologies with potential application across several OIT vision industries. The R&D areas are chosen through a strategic review process which identifies the technologies, practices, and needs that exist throughout industry that can be most cost-effectively leveraged. The program focuses on three areas that offer major improvements in energy efficiency and emissions reduction across all industries: (1) high-efficiency, clean combustion technology that can produce uniform, high-quality end products at high production rates; (2) sensors/control systems that can operate in high temperatures and harsh environments while increasing process efficiency and productivity; and (3) advanced industrial materials that can reduce energy use, lower emissions, increase component life, improve product quality, optimize process operating conditions, and reduce downtime. In addition, a new area of focus is Gasification. Gasification in industrial processes is a critical link to improve efficiency in Forest Products, Chemicals, and Petroleum. Currently the Forest Products industry spends \$4 billion annually to purchase over 90 billion kWh of electricity. Successful adoption of black liquor and biomass gasification technology by the industry will not only totally eliminate these costs, but will result in the industry providing over 20 GW of additional generating capacity to the grid (equivalent of 20 large coal generation power plants).

Goals and Performance Measures:

- **Gasification** - Demonstrate a single black liquor or biomass gasification technology for the Forest Products industry.
- **Integrated Materials** (formerly Advanced Industrial Materials) - Continue development and testing of new membrane technologies, infrared and plasma heat-treating processes, and additional inter-metallic alloys.
- **Combustion** - Continue development of technologies to increase boiler efficiencies and reduce emissions.
- **Sensor/Control Systems** - Continue development of on-line measurement systems and commercialize two integrated sensor and control systems to significantly improve process efficiency.
- **Sensor/Control Systems** - Continue development of wireless sensors for industrial applications and a new family of sensors for applications in high-temperature, reactive, corrosive, and sometimes toxic environments.

Benefits:

Advances in enabling technologies will improve materials performance, increase industrial process control, and improve gasification and combustion efficiency.

**Financial Assistance Program**

The OIT Financial Assistance Program helps independent inventors, small businesses, and industry who lack the funds and/or know-how to move promising energy-saving and energy production technologies from the research bench to the marketplace. Technologies face a tremendous barrier to acceptance unless this important and unique assistance is provided at the make-or-break intersection on the road to technology commercialization. The Financial Assistance Program provides critical financial assistance in the form of competitive grants to develop and deliver clean, energy-saving technologies; and leverage financial and non-financial resources in cooperation with industry. Most important, these innovations can impact bottom-line performance and provide a sustainable competitive advantage for U.S. industry. The program works with IOF industry partners and suppliers to conduct cost shared research and demonstration projects that have a broad range of applications and benefits that will significantly reduce energy use, minimize waste and increase productivity in specific or multiple vision industries. Program components include the Inventions and Innovation (I&I) Program and the National Industrial Competitiveness through Energy, Environment, and Economics (NICE<sup>3</sup>) Program that make a real difference by providing modest levels of support, at the right time, to speed the development of new energy-saving, environmentally friendly technologies and demonstrating their potential savings and commercial value.

Goals and Performance Measures:

- **I&I** - Continue to support the development of promising energy inventions with a focus on their entry into the marketplace.
- **NICE<sup>3</sup>** - Continue to support the demonstration of the commercial viability of promising energy technologies with a focus on their use in the industrial marketplace.

Benefits:

Results of I&I and NICE<sup>3</sup> research and demonstration projects are being applied throughout the vision industries. Continued deployment of these technologies are expected to result in energy savings, waste reduction and productivity savings.

### **Industrial Technology Assistance Program**

The Industrial Technical Assistance program, which includes Best Practices and the Industrial Assessment Centers (IACs), provides the integrated delivery of energy-saving products, services, and technologies to assist the nine IOF in identifying and realizing their best energy efficient, pollution-preventing options from a systems and life-cycle cost perspective. The program facilitates the adoption of emerging technologies and provides technical assistance to boost the productivity of industrial operations. Advanced technology solutions that have been developed with OIT support are emerging from research and development and are ready for demonstration and use. Best Practices facilitates the delivery of these technology solutions to industry through showcase demonstrations and technology implementation assistance. Showcases demonstrate emerging technologies and their performance benefits under real-use conditions and provide an independent third party validation of performance and costs in comparison to baseline practices. Technology implementation assistance involves cost-shared support of emerging technologies to facilitate their adoption. Best Practices and the IACs also provide technical assistance to target immediate cost-saving opportunities and productivity improvements for IOF customers. Technical assistance includes a continuum of services-from energy assessments and evaluations, through information on industrial equipment and systems, to tools and resources for measuring the effectiveness of new technologies.

#### Goals and Performance Measures:

- **Best Practices** – Continue to achieve significant energy savings and productivity savings through plant-wide energy assessments, documented energy saving case studies, and the accelerated adoption by industry of the best-available and emerging technologies and best practices.
- **IAC** – Continue to train students and conduct assessments of industrial plants which will result in significant energy and productivity savings.

#### Benefits:

The Industrial Assessment Centers and Best Practices provide hands-on assistance to industry and disseminate information on operating practices and advanced technologies that can help plant managers save energy. Program statistics for Best Practices show that for every dollar of federal investment, \$4 in energy is saved. Also, the IAC database shows that each assessment results in about \$58,000 in energy and productivity savings.

### **Industries of the Future (Crosscutting) Accomplishments**

#### FY 2000 Accomplishments:

- Continued support for Industrial Assessment Centers operating at 30 participating universities that conducted approximately 750 combined energy, waste, and productivity assessments.

- Established partnerships with 50 Industries of the Future plants to provide integrated delivery of tools and technical assistance to target motors, steam, compressed air, and combined heat and power system opportunities.
- Demonstrated an advanced dilute oxygen combustion system that provided increased efficiency.
- One award made to begin work in black liquor gasification for the Forest Products industry.
- Developed higher efficiency radiant burner using advanced continuous fiber ceramic composites (CFCC) material.
- New materials and process recommendations for improved performance, safer, and more efficient materials in Kraft recovery boilers were demonstrated.
- The NICE<sup>3</sup> program provided assistance to 8 State/industry partnerships for the initial demonstration of energy efficiency technologies, which will facilitate their use in other industrial facilities.
- The I&I program provided assistance to 28 inventors and small businesses to develop their meritorious energy efficiency technologies.

*FY 2001 Ongoing Accomplishments:*

- Continue support for Industrial Assessment Centers operating at 26 participating universities that will conduct approximately 650 combined energy, waste, and productivity assessment days of service to manufacturing clients.
- Complete 15 assessments on 5 case studies of major industrial plants that will document for a variety of system-focused implemented actions. These will influence replication of similar energy savings for other plants.
- Two awards made for biomass gasification engineering design studies for the Forest Products industry.
- Demonstrate less than 10 ppm Nox burner for refinery heaters.
- Complete commercialization of process for the production of uniform metal droplets for metal filters.
- Through the NICE<sup>3</sup> program provide assistance to approximately 13 State/industry partnerships for the initial demonstration of energy efficiency technologies, which will facilitate their use in other industrial facilities.
- Through the I&I program, provide assistance to approximately 41 inventors and small businesses to develop their meritorious energy efficiency technologies.

*FY 2002 Planned Accomplishments:*

- Continue support for Industrial Assessment Centers operating at 26 participating universities that will conduct approximately 320 combined energy, waste, and productivity assessment days of service to manufacturing clients.
- Complete two showcase demonstrations, at industry sites of advanced energy efficient technologies.
- Complete six plant site assessments to assist plant operators in use of industrial process applications tools. These will influence replication of similar energy savings for other plants.
- Complete testing and evaluation of prototype boiler and commercial process heater designs capable of improved efficiency and less than 5 ppm NO<sub>x</sub> emissions.
- Complete design studies and site selection for a biomass gasifier demonstration.
- Complete commercialization of infrared and plasma heating process for metal heat treating and hard coating placement

**I. A. Funding Table: INDUSTRIES OF THE FUTURE (CROSSCUTTING)**

Program Activity	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	\$ Change	% Change
Enabling Technologies . . . . .	\$ 26,067	\$ 30,529	\$ 14,863	\$ -15,666	-51.3%
Distributed Generation . . . . .	\$ 0	\$ 0	\$ 0	\$ 0	0.0%
Financial Assistance . . . . .	\$ 10,310	\$ 10,240	\$ 5,108	\$ -5,132	-50.1%
Technical Assistance . . . . .	\$ 16,375	\$ 15,948	\$ 8,929	\$ -7,019	-44.0%
Technical / Program Management Support . . . . .	\$ 4,857	\$ 5,002	\$ 3,000	\$ -2,002	-40.0%
Total, Industries of the Future (Crosscutting) . . . .	<u>\$ 57,609</u>	<u>\$ 61,719</u>	<u>\$ 31,900</u>	<u>\$ -29,819</u>	<u>-48.3%</u>

Note: Industries of the Future (Crosscutting) includes \$800 for the State Energy Program Special Projects State Grants, in FY 2002, \$1,460 in FY 2001, and \$1,600 in FY 2000. Decrease State IOF awards from 14 to 7.

## II. B. Laboratory and Facility Funding Table: INDUSTRIES OF THE FUTURE (CROSSCUTTING)

	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	\$ Change	% Change
Argonne National Laboratory (East) . . . . .	\$ 195	\$ 150	\$ 78	\$ -72	-48.0%
Idaho National Engineering Laboratory . . . . .	\$ 551	\$ 320	\$ 165	\$ -155	-48.4%
Lawrence Berkeley National Laboratory . . . . .	\$ 989	\$ 1,420	\$ 734	\$ -686	-48.3%
Lawrence Livermore National Laboratory . . . . .	\$ 198	\$ 0	\$ 0	\$ 0	0.0%
Los Alamos National Laboratory . . . . .	\$ 950	\$ 1,050	\$ 543	\$ -507	-48.3%
National Renewable Energy Laboratory . . . . .	\$ 2,156	\$ 1,665	\$ 861	\$ -804	-48.3%
Oak Ridge National Laboratory . . . . .	\$ 13,898	\$ 14,235	\$ 7,358	\$ -6,877	-48.3%
Pacific Northwest National Laboratory . . . . .	\$ 105	\$ 500	\$ 258	\$ -242	-48.4%
Sandia National Laboratories . . . . .	\$ 904	\$ 800	\$ 413	\$ -387	-48.4%
All Other . . . . .	\$ 37,663	\$ 41,579	\$ 21,490	\$ -20,089	-48.3%
Total, Industries of the Future (Crosscutting)	<u>\$ 57,609</u>	<u>\$ 61,719</u>	<u>\$ 31,900</u>	<u>\$ -29,819</u>	<u>-48.3%</u>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING)

Program Activity	FY 2000	FY 2001	FY 2002
<b>Enabling Technologies</b>	All Engineered Ceramics/CFCC, and Advanced Industrial Materials activities relating to the OPT/DER program, with their related funding, have been transferred to OPT.	All Engineered Ceramics/CFCC and Advanced Industrial Materials activities relating to the OPT/DER program, with their related funding, have been transferred to OPT.	All Engineered Ceramics/CFCC and Advanced Industrial Materials activities relating to the OPT/DER program, with their related funding, have been transferred to OPT.
			<b>Industrial Materials for the Future</b>
			Initiate Industrial Materials for the Future. Complete 5 CFCC projects. Complete 7 AIM projects.
			Issue two competitive solicitations, one to industry and universities, and one to National Laboratories. Solicitations will be based on IOF Vision team roadmap materials priorities. (\$6,698)
	<b>Engineered Ceramics/CFCCs</b>	<b>Engineered Ceramics/CFCCs</b>	<b>Engineered Ceramics/CFCCs</b>
	Collaborative partnerships with industry, national laboratories, and universities developed CFCCs with superior high-temperature strength and fatigue resistance, corrosion resistance, and wear resistance for various applications in the Vision Industries. Developed and demonstrated processing methods	Development, testing, and demonstrating CFCCs with superior high temperature strength and fatigue resistance, corrosion resistance, and wear resistance for various applications in the Vision Industries continued. Industries that adopt CFCCs will realize substantial energy, economic and	In FY 2002 Engineered Ceramics/CFCCs and Advanced Industrial Materials will become part of a new materials program, "Industrial Materials for the Future." This direction is based on recommendations in a National Research Council/National Materials Advisory Board study

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	<p>for reliable and cost-effective ceramic composites scaled-up to sizes and shapes consistent with industry needs for key near-term and intermediate-term applications. Applications included immersion tubes for molten metals, hot gas filters, radiant burners, heat exchangers, and refinery pipe hangers. Long-term testing and exposure of representative CFCC components such as hot gas filters, and radiant burners was performed under application conditions for hundreds to thousands of hours.</p> <p>Developed and tested advanced ceramics and coatings for industrial manufacturing processes.</p> <p>The supporting technology infrastructure was an integrated effort which addressed the design methodologies for advanced ceramics (including CFCCs), the role of material characteristics on mechanical performance, testing techniques for accurately evaluating their performance, and the development of a data base which included life and long-term reliability in appropriate</p>	<p>environmental benefits, including higher efficiency, lower maintenance and decreased operating costs. The team will demonstrate processing methods and feasibility of process scale-up for reliable and cost-effective ceramic composites in actual sizes and shapes consistent with industry needs for key near-term and intermediate term applications. Applications include immersion tubes for molten metals, hot gas filters for particle separation, radiant burners for glass bending, and drying applications. Long term testing and exposure of representative CFCC components will be performed under application conditions for hundreds to thousands of hours. These long term exposures will allow for the collection of data to support the benefits of using CFCCs and support industrial adoption and commercialization.</p> <p>The supporting technology effort for advanced ceramics (including CFCCs) is continuing to support the needs of industry. These efforts will build on results obtained from</p>	<p>completed in December 1999. Study participants also included many of our industrial customers.</p> <p>In FY 2000 we began a study based on the NMAB recommendations to determine the best way to proceed with the design of a single materials program, open to industry, national laboratories and universities through a competitive process, for implementation in FY 2002.</p> <p>Complete program with final funding for five projects under new Industrial Materials for the Future program.</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	<p>environments. These efforts helped build the scientific foundation for the successful design, fabrication, characterization, and utilization of advanced ceramics for industrial applications. (\$4,710)</p> <p>Participants included: Allied Signal Ceramics, Engineered Composites, Inc., Dupont Lanxide, General Electric, McDermott Technologies, Textron Systems, Oak Ridge National Laboratory, Argonne National Laboratory</p>	<p>field testing and the supporting technology team will evaluate components that have been tested in operating conditions for a better understanding of material properties and failure methods. Databases that include life and long-term reliability in appropriate environments is being expanded. These efforts help build the scientific foundation for the successful design, fabrication, characterization, and utilization of advanced ceramics for industrial applications. (\$6,203)</p> <p>Participants include: Allied Signal Ceramics, Engineered Composites, Inc., General Electric, McDermott Technologies, Textron Systems, Oak Ridge National Laboratory, Argonne National Laboratory.</p>	
	<b>Advanced Industrial Materials</b>	<b>Advanced Industrial Materials</b>	<b>Advanced Industrial Materials</b>
	<p>The Advanced Industrial Materials (AIM) Program developed and deployed advanced intermetallic alloys, other high temperature alloys, polymers, membrane materials, and metal matrix</p>	<p>The focus of intermetallic alloy research and development was shifted from nickel aluminide, which is a mature material being demonstrated by industry, to more rapid development of iron</p>	<p>Complete program with final funding for 7 projects under new Industrial Materials of the Future Program.</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	<p>composites for the IOF. These materials were designed to meet specific needs to improve productivity, product quality and energy efficiency in the Vision Industries.</p> <p>Development of standardized test methods and physical process data bases were begun to enable qualification of these materials in industrial applications. The process for production of uniform spherical metal powders over a wide range of steels and intermetallic alloys was scaled up, in cooperation with industry partners. Work on development of inorganic membranes and electrochemical reactors for harsh chemical environments was turned over to the IOF Chemical Industry Team for industrial demonstration. Work on metal matrix composites, with superior strength and wear resistance was completed. Activities of the Metals Processing Laboratory (MPlus) at Oak Ridge National Laboratory was enhanced for the benefit of the industries and universities engaged in development of new and improved</p>	<p>aluminides, molybdenum and other silicides, and titanium aluminides. (\$6,176)</p>	

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	<p>high temperature alloys for use in corrosive environments in the vision industries. (\$5,110)</p> <p>Participants included: Oak Ridge National Laboratory, Sandia National Laboratory, Argonne National Laboratory, Weyerhaeuser, PPG Industries, Dow Chemical, Amoco, and other industry partners in CRADAs and other cooperative agreements.</p> <p><b>Combustion Systems</b></p> <p>The combustion program initiated projects to meet combustion vision and roadmap targets. A project was awarded for engineering design, development and demonstration of a Super Boiler. A second project was awarded for engineering design, development, and demonstration of an advanced refinery process heater. These two projects address the following targets: environmental quality (two parts per million NOx is a long term goal for boilers), fuel flexibility (maximize the use of multiple fuels, including waste and renewable</p>	<p>Participants include: Oak Ridge National Laboratory, Sandia National Laboratory, Argonne National Laboratory, Weyerhaeuser, PPG Industries, Dow Chemical, Amoco, and other industry partners in CRADAs and other cooperative agreements.</p> <p><b>Combustion Systems</b></p> <p>The combustion program is continuing to fund the two program areas awarded in FY 2000, boilers and process heating. Both are multi-year projects with completion anticipated in FY 2004. (\$1,690)</p>	<p><b>Combustion Systems</b></p> <p>Continue super boiler program to meet combustion vision and roadmap targets. This project will build on advances made in very low emission burner projects through improved systems design and better heat transfer. (\$791)</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	fuels), energy efficiency (or 20 to 50 percent specific fuel consumption reduction is a long term goal for furnaces), cost effectiveness (lower life cycle costs), and improved system reliability (double the time between scheduled boiler outages). In the process heater area, an improved heater design could lower specific fuel consumption by 20 percent. (\$1,950)		
	<b>Industrial Gasification</b>  Presented here for required comparability, the following efforts are funded in FY 2000 through the Fossil Energy R&D Program. Initiated preliminary design studies, including R&D, engineering design, and cost projections. A competitive solicitation identified technology development and demonstrations of advanced biomass and black liquor gasification systems. Technology development included improved refractory performance, systems integration with combined cycle systems and gas clean-up. Projects funded have a clear path to	<b>Industrial Gasification</b>  Gasification in industrial processes is a critical link to improve efficiency of processes in Forest Products, Chemicals and Petroleum. Utilization of the low and medium Btu fuels, such as black liquor in the pulp and paper process, produced by Gasification opens new process opportunities for these industries. Design study awarded in FY 2000 continues. Two additional awards are being made for engineering design, cost projections, and identification of critical R&D needs for systems in industrial plants.	<b>Industrial Gasification</b>  Based on results of 3 engineering design studies, select one project to proceed to construction and demonstration. (\$6,600)

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	<p>demonstration and commercialization of systems in the forest products industry. (\$12,659)</p> <p>Participants included: Industrial boiler manufacturers, burner manufacturers, process heater and furnace manufacturers.</p>	<p>Funding and oversight will be in OIT with project management implemented through National Energy Technology Laboratory (NETL). Solicitation is being issued for a technology support program guided by industry and utilizing the expertise of NETL, ORNL and NREL. Supporting technical areas include sulfur management, gas clean-up, materials, systems integration and other combustion related studies. (\$12,697)</p> <p>Participants include: Georgia Pacific, Gaylord Container, Boise Cascade, GTI, Thermo-Chem, Fluor-Daniel, Oak Ridge National Laboratory, National Energy Technology Laboratory, and National Renewable Energy Laboratory.</p>	<p>Participants include: Georgia Pacific, Gaylord Container, Boise Cascade, GTI, Thermo-Chem, Fluor-Daniel, Oak Ridge National Laboratory, National Energy Technology Laboratory, and National Renewable Energy Laboratory.</p>
	<p><b>Sensors and Control Technologies</b></p> <p>The Sensors and Controls Program continued to develop and deploy integrated measurement systems for operator-independent control of manufacturing processes with broad applicability across multiple</p>	<p><b>Sensors and Control Technologies</b></p> <p>The Sensors and Controls Program is continuing to implement its Program Plan to achieve leap-frog advancement of sensor and control technologies that have high impact</p>	<p><b>Sensors and Control Technologies</b></p> <p>The Sensors and Control program will continue to identify, develop and deploy crosscutting technologies that ultimately can meet performance requirements specified in the IOF</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	<p>industry sectors. In collaboration with major industrial associations and instrumentation manufacturer societies, the Sensors and Controls Program will implement a comprehensive technology development strategy to meet the needs identified in the individual industry technology roadmaps. Particularly needed is improved technology both in sensors including compatibility with high temperature and harsh environment applications and in information processing from different sensory modalities to detect and remedy malfunctions. (\$1,638)</p>	<p>on two or more IOF industries. Focus will be on bringing projects into the field demonstration phase and continuing the bench-scale research and development of projects awarded in FY 2000. Notable demonstrations include 1) an online, laser-based ultrasonic system to measure wall thickness and eccentricity of steel seamless mechanical tubing during piercing, elongation, and rotary sizing operations, 2) an intelligent extruder which incorporates low-cost, readily available sensors into inferential control to produce quality resin products in polymer compounding, and 3) a non-proprietary, dynamically reconfigurable, wireless-network architecture that provides standardized communication protocols and data structures for robust performance in industrial environments. Bench-scale research and development is focusing on achieving major improvements of sensor attributes such as self-diagnostics and self-calibration, high-speed measurements with accuracy and reliability, as well as those for</p>	<p>Roadmaps and thus help the IOFs to attain Vision goals. Continue to achieve advances in non-proprietary, dynamically, reconfigurable wireless architecture and conduct field trials in industrial plants, complete laboratory development and evaluation of a realtime sensor to measure constituents in industrial melts in the aluminum, glass and steel industries, apply thermal imaging system to operating steel and glass furnaces to improve operating energy efficiency. (\$774)</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	Participants include: Institute of Gas Technology/U. Of Illinois/Combustion Tec/Owens Brockway Glass Containers/Acme; GE Research & Development Center/Krupp Werner-Pfleiderer; Visteon Automotive Systems/Sandia National Laboratory/U. of Utah; Energy Research Company/Mississippi State University/Oak Ridge National Laboratory; Tennessee Technological University/Utah State U./Idaho National Engineering Laboratory/Albany Research Center/American Foundrymen's Society/General Motors.	harsh-environment (high temperature or corrosive) sensing. (\$3,763)  Participants include: Timken Company, Gas Technology Institute, GE Research & Development Center, PPG, Energy Research Company, Tennessee Technological University, Oak Ridge National Laboratory, T/J Technologies Inc., Detection Limit Inc., and Concurrent Technologies Corporation, National Research Council Canada, University of Illinois, Combustion Tec, Owens Brockway Glass Containers, Krupp Werner-Pfleiderer, Sandia National Laboratories, and University of Utah, Mississippi State University, and Utah State University, Idaho National Engineering Laboratory, Albany Research Center, American Foundrymen's Society, and General Motors.	Participants include: Timken Company, Gas Technology Institute, GE Research & Development Center, PPG, Energy Research Company, Tennessee Technological University, Oak Ridge National Laboratory, T/J Technologies Inc., Detection Limit Inc., and Concurrent Technologies Corporation.  Also participating in the collaboration are National Research Council Canada; University of Illinois, Combustion Tec, Owens Brockway Glass Containers; Krupp Werner-Pfleiderer; Sandia National Laboratories, and University of Utah; Mississippi State University; and Utah State University, Idaho National Engineering Laboratory, Albany Research Center, American Foundrymen's Society, and General Motors.
<b>Total, Enabling Technologies</b>	<b>\$26,067</b>	<b>\$30,529</b>	<b>\$14,863</b>
<b>Distributed Generation</b>	<b>Industrial Power Generation</b>	<b>Industrial Power Generation</b>	
	Transferred the program to Power	Transferred the program to Power	

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	Technologies. (\$0)	Technologies. (\$0)	
	<b>Industrial Distributed Generation</b>	<b>Industrial Distributed Generation</b>	
	Transferred the program to Power Technologies. (\$0)	Transferred the program to Power Technologies. (\$0)	
<b>Total, Distributed Generation</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>Financial Assistance</b>	<b>Financial Assistance</b>	<b>Financial Assistance</b>	<b>Financial Assistance</b>
	OIT introduced an integrated delivery system of financial assistance services in the form of grants. The Program addressed industry requests for a simpler, more flexible package of services that is easier for industry to access. By reducing overhead activities, additional worthy projects are supported. The programs work with regional centers to more effectively leverage local resources and to better tailor assistance to specific needs and situations. The NICE <sup>3</sup> and Inventions Programs issued approximately 36 new grants.	OIT is continuing the integrated delivery system of financial assistance service. The Program continues to provide industry with a simpler, more flexible package of services that is easier for industry to access. By continuing to reduce overhead activities, additional worthy projects will be supported. The programs continue to work with regional centers to more effectively leverage local resources and to better tailor assistance to specific local needs and situations. The NICE <sup>3</sup> and Inventions Programs will be issuing approximately 54 new grants.	There are numerous energy-saving technologies that have been developed to the point of readiness for a first-time demonstration. However, they do not have the resources to accomplish this testing. The NICE <sup>3</sup> component of Financial Assistance provides significant "leverage" by identifying and supporting the first-time demonstrations of these technologies.  There are numerous energy-savings technologies conceived by individual inventors and small businesses that are in need of additional support to complete their research and testing. The inventors and small businesses often do not
Financial Assistance (Cont'd)			

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Financial Assistance (Cont'd)	<p><b>NICE<sup>3</sup></b></p> <p>NICE<sup>3</sup> continued to provide a voluntary, non-regulatory approach to improve competitiveness, foster energy efficiency, and reduce waste. The program worked closely with the Inventions and Innovation (I&amp;I) program to support an integrated delivery of OIT's financial assistance services. Competitive solicitations for both programs were issued on concurrent schedules.</p>	<p><b>NICE<sup>3</sup></b></p> <p>NICE<sup>3</sup> continues to provide a voluntary, non-regulatory approach to improve competitiveness, foster energy efficiency, and reduce waste.</p> <p>The program continues to work closely with the I&amp;I program to support an integrated delivery of OIT's financial assistance services. Competitive solicitations for both programs continues to be issued on concurrent schedules.</p>	<p>have the resources and know-how to further the development of their ideas. The Inventions and Innovation component of Financial Assistance provides significant "leverage" by identifying and supporting the further development of these technologies.</p>
	<p>Administrative streamlining, and the use of regional centers allowed for more effective leveraging of local resources and enhanced the ability of both programs to better meet specific regional industry needs. See the Financial Assistance description above. (OIT focus industries, the dominant energy</p>	<p>Administrative streamlining, and the use of regional centers will continue to allow for more effective leveraging of local resources and enhance the ability of both programs to better meet specific regional industry needs. See the Financial Assistance description above. (OIT</p>	<p><b>NICE<sup>3</sup></b></p> <p>The NICE<sup>3</sup> program will provide financial assistance to demonstrate energy saving technologies in IOF industries. (The OIT focus industries, the dominant energy users and waste generators in the U.S. manufacturing and industrial sectors, will be primary recipients of the approximately 4 grants to be awarded in FY 2002.) (\$2,736)</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	users and waste generators in the U.S. manufacturing and industrial sectors, were the primary recipients of the 8 grants awarded.). (\$5,923)	focus industries, the dominant energy users and waste generators in the U.S. manufacturing and industrial sectors, are the primary recipients of the approximately 13 grants to be awarded this year). (\$5,442)	
	<b>Inventions and Innovation</b>	<b>Inventions and Innovation</b>	<b>Inventions and Innovation</b>
Financial Assistance (Cont'd)	The I&I Program continued to provide financial assistance to support the development of new energy efficient technologies. The program worked closely with the NICE <sup>3</sup> Program to support an integrated delivery of OIT's financial assistance services to IOF partners. Twenty-eight I&I grants were awarded. The I&I Program reaches typically under served population of independent inventors and small start-up businesses. The program received more than 35,000 applications for financial assistance since its inception in 1974. Nearly 25 percent of the technologies funded have reached commercial success. The successful technologies supported by this program have saved enough energy to light six million homes for one	The I&I Program will continue to provide financial assistance to energy efficient technologies. The program will continue to work closely with the NICE <sup>3</sup> Program to support an integrated delivery of OIT's financial assistance services to IOF partners. (This year the I&I program is expected to award approximately 41 grants to independent inventors and small technology-based businesses through competitive processes. On average, the program receives nearly three times as many worthy proposals as it can fund. This means 25 - 30 good proposals go unfunded each year. These recipients change from year to year). (\$4,798)	The I&I Program will provide financial assistance to energy saving technologies initiated by this program in FY 2001. (\$2,372)

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	year. (\$4,387)		
<b>Total, Financial Assistance</b>	<b>\$10,310</b>	<b>\$10,240</b>	<b>\$5,108</b>
<b>Technical Assistance</b>	<b>Technical Assistance Activities</b>	<b>Technical Assistance Activities</b>	<b>Technical Assistance Activities</b>
	In order to respond to its industry partners, OIT introduced an integrated system for delivery of technologies, tools, and technical assistance to thousands of plants.	No activity. (\$0)	No activity. (\$0)
	At the core of the integrated delivery strategy is the development of one-on-one ongoing partnerships between OIT and its IOF industry partners at the plant level. OIT's efforts model the success achieved since 1998 at Bethlehem Steel's Burns Harbor plant and other showcase plant sites. In 2000, each of the IOF industries had at least one major showcase initiative in partnership with OIT. (\$278)		
Technical Assistance (Cont'd)	Participants were selected from the 9 IOF target industries.		
	<b>Industrial Assessment Centers</b>		

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	<p>IACs conducted approximately 750 combined energy, waste, and productivity assessments were conducted. Top performing schools were given new incentives to look at and evaluate innovative program approaches. Collaborative work with State agencies continued. Work that strengthens university and local industry cooperation continued. Collaboration with the NIST Manufacturing Extension Program centers continued. The students continued to transfer best practices learned through the program to U.S. manufacturers all across the nation. 2,300 students were trained by the IAC program. Work continued at the national level to share results of successful IACs/NIST Manufacturing Extension Program Centers collaboration.</p>	<p><b>Industrial Assessment Centers</b></p> <p>OIT continues to support IACs efforts to provide hands-on training at 26 participating universities in energy and waste management to an additional 150 engineering students and to conduct approximately 650 new combined energy, waste, and productivity assessments. The program works closely with the other OIT Technical Assistance programs to fully support an integrated delivery of services and provides industrial assessment expertise to identify and capitalize on technology applications at participating showcase plants. The IAC database, with data on over 9,000 industrial assessments, helps these plants target specific opportunities for efficiency. Engineering students who have worked with the 26 IACs nationwide continue to graduate with the experience and skills necessary to implement energy efficiency, waste reduction, and productivity improvements. Recommendations from the Strategic Program Review are</p>	<p><b>Industrial Assessment Centers</b></p> <p>Provide energy, waste, and productivity training to 150 engineering students at 26 participating universities. Conduct approximately 320 assessment days of service to manufacturing clients. The program will work closely with other OIT programs to deliver industrial services in an integrated fashion. Provide industrial assessment technical expertise to Industries of the Future Showcase Plants. (\$3,859)</p>
	<p>Started to implement recommendations from the Strategic Program Review.</p>		
	<p>Conducted solicitation for new Centers. The following schools were selected: Arizona State</p>		

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	University, Bradley University (Illinois), Colorado State University, Georgia Institute of Technology, Iowa State University, Leigh University, Loyola Marymount University, Mississippi State University, North Carolina State University, Oklahoma State University, Oregon State University, San Diego State University, San Francisco State University, Syracuse University, Texas A&M University, University of Dayton, University of Florida, University of Illinois at Chicago, University of Louisiana-Lafayette, University of Massachusetts, University of Miami, University of Michigan, University of Texas - Arlington, University of Utah, University of Wisconsin - Milwaukee, West Virginia University. (\$7,754)	being implemented.  Conducted a solicitation for Special Projects to provide IACs the opportunity to perform work that compliments OIT's R&D activities, student projects on industrial efficiency, and regional and local initiatives that support DOE objectives. Projects support the research objectives of the professor and the institution or department. Project results will be presented to IAC Directors, incorporated into the integrated delivery process, presented at conferences, published in technical journals, and made available via the internet. Special Projects are in addition to industrial assessments. (\$7,694).	
Technical Assistance (Cont'd)	<p><b>Best Practices</b></p> <p>Previously funded under Technology Transfer, Combined Heat and Power (CHP), Motor, Compressed Air, and Steam. (\$0)</p>	<p><b>Best Practices</b></p>	<p><b>Best Practices</b></p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)		<p>In FY 2001, in order to provide better customer service and to reduce costs, OIT has initiated the Best Practices Program which will integrate the activities of the following programs: (Combined Heat and Power, Motors and Compressed Air, Process Heating and Steam). The program helps U.S. manufacturers by providing credible technical information and assistance to help them lower their energy bills, often with little or no capital investment. (\$0)</p>	<p>Technical assistance to 6 plant sites regarding use of industrial process application tools relevant to motor, pump, process heating, steam and compressed air systems will be provided. Eight plant-wide assessments will be selected for cost-shared financial assistance and develop a comprehensive energy-saving strategy for the selected plants. The Allied Partnership will be broadened to include industry and trade associations representing all IOF industries to support wide dissemination and use of OIT information and products. System-level improvements of motor and steam operations accomplished through implementation of energy management best practices will achieve 10 percent of the potential energy savings available. A Best Practices Resource Software Suite will be developed for decision-making across plant operations; the Suite will integrate energy assessment software with information products and will provide links to IOF technologies/products.</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	Combined Heat and Power (CHP)		Two plant-wide showcases will be completed, in support of IOF partnerships, to demonstrate emerging technologies and their performance benefits under real-use conditions. Eight emerging technologies will have their energy/environment/ economic performance validated by an independent, third-party entity to help promote industry acceptance of using new technologies. Support will be provided to three states in their implementation of energy-saving technologies as part of state-IOF efforts. (\$5,070)
	CHP technical assistance activities were focused on addressing the barriers and providing the technical tools and expertise necessary to demonstrate to industry how successful CHP technologies are, and to increase awareness of and confidence in these technologies. The program continued to work with the other OIT Technical Assistance programs to fully support an integrated delivery of services making CHP an important technology option for IOF industries.	Combined Heat and Power (CHP)	Combined Heat and Power (CHP)
	Participants included: State Energy	Recent technological advances have made CHP systems more efficient and less expensive. The energy efficiency of CHP systems can exceed 80 percent. Additionally, CHP has been identified as one of the most near term cost-effective sections to reduce global carbon emissions. The effort supports the joint DOE-Industry goal to double the amount of CHP capacity in the	Moved to the Power Technologies as part of the Distributed Energy Resources (DER) program. (\$0)

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	Offices, Onsite Energy, Washington State University, Oak Ridge National Laboratory, Allison Engines. (\$0)	U.S. by 2010, equal to 46 gigawatts of electricity and reduce air pollution by 40 million metric tons of carbon. The program continues to work with the other OIT Best Practices programs to fully support an integrated delivery of services making CHP an important technology option for IOF industries. CHP technical assistance activities will continue to focus on addressing the barriers conducting CHP technology assessments and providing the technical tools and expertise necessary to demonstrate to industry how successful CHP technologies are, and to increase awareness of and confidence in these technologies. Industry is completing technology and barrier elimination roadmaps. (Funding requested under Best Practices Program above)	
	Motors and Compressed Air	Participants include: State Energy Offices, Onsite Energy, Washington State University, Oak Ridge National Laboratory, Allison Engines. (\$0)	
	Motors and compressed air are both motor driven systems. Technical		

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	<p>assistance support and expertise in these areas was provided as critical components of OIT's integrated delivery of technical assistance services. The programs continued to work with manufacturers to identify and target new energy efficiency and productivity opportunities and to help them develop and refine the credible, unbiased tools that assist industry in making the most informed energy decisions. (\$7,093)</p> <p>Participants included: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International, Washington State University Extension Office.</p>	<p>Motors and Compressed Air</p> <p>Motors and compressed air technical assistance support and expertise is provided as critical components of OIT's integrated delivery of technical assistance services under the Best Practices Program. The programs continue to work with manufacturers to identify and target new energy efficiency and productivity opportunities and to help them develop and refine the credible, unbiased tools that assist industry in making the most informed energy decisions. (Funding requested under Best Practices Program above) (\$7,020)</p> <p>Participants include: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International, Washington State University Extension Office.</p>	<p>Motors and Compressed Air</p> <p>Transferred and consolidated under the Best Practices Program. (\$0)</p>
	<p>Steam</p> <p>The Steam Challenge, which was run under the Motor Challenge budget in FY99, was a full fledged initiative jointly partnered by DOE and the Alliance to Save Energy.</p>	<p>Steam</p> <p>The Steam Program continues to be a full-fledged initiative jointly</p>	<p>Steam</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	<p>Technical assistance, information and tools were provided to plants interested in improving the energy efficiency of their steam systems and industrial heating equipment. The Steam program worked with suppliers, equipment manufacturers and end-users to garner the greatest impact. At the same time integrated delivery of technical assistance provided the right level of assistance to each plant. (\$1,250)</p> <p>Participants included: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International, Washington State University Extension Office, Alliance to Save Energy.</p>	<p>partnered by DOE and the Alliance to Save Energy under OIT's integrated delivery effort under the Best Practice Program. Technical assistance, information and tools are being provided to plants interested in improving the energy efficiency of their steam systems and industrial heating equipment. This program provides valuable unbiased information on system design, equipment, purchase, and operation from experts with practical experience addressing steam system challenges. As with motors and compressed air, this program aims to increase U.S. industrial energy efficiency by helping industry adopt the systems approach with boilers, steam distribution systems, steam applications, furnaces and other equipment. The Steam program is working with suppliers, equipment manufacturers and end-users to garner the greatest impact. At the same time integrated delivery of technical assistance provides the right level of assistance to each plant as part of the Best Practices Program. (Funding requested under</p>	<p>Transferred and consolidated the program under the Best Practices Program. (\$0)</p>

### III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

<b>Program Activity</b>	<b>FY 2000</b>	<b>FY 2001</b>	<b>FY 2002</b>
		Best Practices Program above). (\$1,234)	
		Participants include: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International.	
<b>Total, Technical Assistance</b>	<b>\$16,375</b>	<b>\$15,948</b>	<b>\$8,929</b>
<b>Technical/Prog. Management Support</b>	Provide critical technical and program management support services. (\$4,857)	Provide critical technical and program management support services. (\$5,002)	Provide critical technical and program management support services. (\$3,000)
<b>Total, Technical / Prog. Management Support</b>	<b>\$4,857</b>	<b>\$5,002</b>	<b>\$3,000</b>

**III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)**

<b>Program Activity</b>	<b>FY 2000</b>	<b>FY 2001</b>	<b>FY 2002</b>
<b>TOTAL, INDUSTRIES OF THE FUTURE (CROSS- CUTTING)</b>	<b>\$57,609</b>	<b>\$61,719</b>	<b>\$31,900</b>